UCRL-JC-123597 Abs

RAPID GROWTH OF KH_2PO_4 CRYSTALS IN 1,000 LITER CRYSTALLIZERS

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Crystallizers with growth solution volumes of 1,000L have been constructed for the growth of KH_2PO_4 (KDP) single crystals up to a size of 50x50x50cm as required for the National Ignition Facility at Lawrence Livermore National Laboratory. The design was based on that of the small, 5-20 L crystallizers which currently allow us to growth high quality KDP and DKDP crystals up to 17 cm in size at the growth rates of 10-30 mm/day and with the yields close to 100%. Growth solutions demonstrate high stability against spontaneous nucleation. Relative supersaturations of up to 50% have been achieved during continuous cooling from saturation points of about 65°C. At a constant supersaturation of 6% (T=60°C), stirred solutions were maintained without crystals for a period of more than one month. The first full scale growth experiments show that crystals can be reproducibly grown at the growth rates up to 20 mm/day. The main limitation in obtaining full size crystals is the formation of solution inclusions sometimes accompanied by cracks and misoriented blocks on {100} faces. These defects appear to be connected with stresses on the crystal in the large crystallizer which are not present in the small crystallizers and are due to the larger solution mass, different tank and platform geometry and hydrodynamic conditions. The results of growth, kinetic, hydrodynamic, X-ray topographic and optical investigations will be presented. This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract No. W-7405-ENG-48.